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# A survey of methods used for post removal in specialist endodontic practice

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## Abstract

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**Aim** The aims of this study were to determine the attitudes of endodontists toward the risk of root fracture when removing posts and to determine which methods they commonly used to remove posts from root-filled teeth.

**Methodology** A survey was sent to all 74 members of the Australian and New Zealand Academy of Endodontists. The survey was divided into three parts to gather information concerning root canal retreatment performed in specialist endodontic practice, attitudes about the risk of root fracture when removing posts and the methods used to remove different post systems.

**Results** Responses were received from 62 (84%) of the Academy members. When a post was present in a tooth

that required root canal retreatment, 66% of the endodontists preferred to remove the post, whilst 27% considered either post removal or periapical surgery. Forty-five per cent reported that a root fracture had occurred during post removal, but this represented less than 0.002% of the estimated number of posts removed by all respondents. Ultrasonic vibration was the most common method used to remove posts, although post removal devices were used more often in anterior teeth; the Egger post remover was the most commonly used device.

**Conclusions** Most endodontists preferred to remove posts rather than perform periapical surgery. Few root fractures were reported. Ultrasonic vibration was the most common method used to remove posts from all tooth types, with the Egger post remover used most commonly for posts in anterior teeth.

**Keywords:** posts, post removal, survey.

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## Introduction

The most common reason for failure of root canal treatment is the presence of microorganisms within the root canal system (Nair *et al.* 1990, Sundqvist *et al.* 1998). When endodontic failure occurs, conservative orthograde retreatment is usually the preferred treatment choice rather than periapical surgery, since retreatment is generally more successful and more predictable (Allen *et al.* 1989).

Orthograde root canal retreatment requires removal of the existing coronal restoration in order to obtain access to the root canal system and this may include removal of a post. There is little information in the dental

literature to indicate how often this is required, although Abbott (1994) analysed the treatment performed on 2000 patients referred to a specialist endodontist and reported that post removal was required for 210 teeth. This represented 9.4% of all teeth treated and 25.7% of the retreatment cases with the majority of posts being removed from maxillary incisors (60.9%).

Articles in the dental literature concerning post removal are mainly discussions of the various techniques for post removal in the form of clinical case presentations. Several techniques can be used to remove posts and these include the use of ultrasonic vibration, solvents with endodontic files, burs to drill the posts out, and post removal devices. Some examples of post removal devices are the Masseran kit (Micro-Méga, Besançon, France), the Egger post remover (Automaton-Vertriebs-Gesellschaft, Germany), the Gonon post remover, which is also called the Thomas Extracteur De Pivots (FFDM, Bourges,

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France) and more recently, the Ruddle post remover (Analytic Endodontics, Orange, CA, USA).

In a survey of American endodontists regarding the methods used to remove posts, Stamos & Gutmann (1993) reported that the majority of respondents used haemostats (67%) or they drilled out the posts (62%). These figures are surprising, and somewhat alarming, particularly regarding the use of a bur to drill out a post. This procedure is very likely to lead to loss of a considerable amount of the surrounding dentine, which may result in root perforation or may weaken the tooth and predispose it to a vertical root fracture. The least common method for removing posts amongst the respondents was the use of post removal devices such as the Gonon post remover, the Egger post remover and the endodontic extractor. Some respondents did not use post removers because they thought they were too dangerous, could not be used universally, or they did not work. Unfortunately, from the survey report, it was not possible to determine the method of post removal in different situations or whether more than one instrument was used to remove posts. Surgical treatment was performed in situations where the post could not be removed or if respondents felt that post removal might cause a root fracture. They were concerned about this, because it is often stated that root fracture may occur with post removal even though there is currently no evidence in the literature to support this empirical claim.

The aims of the current study were to establish the attitudes of endodontists in Australia and New Zealand toward the risk of root fracture when removing posts, and to assess which methods they commonly use to remove posts.

## Materials and methods

A survey of members of the Australian and New Zealand Academy of Endodontists (ANZAE) was conducted in April 1999. The survey was mailed to all 74 members of the ANZAE with an explanatory letter and a stamped pre-addressed return envelope. The survey was divided into three parts to obtain the following information:

**1** Details of previous undergraduate and postgraduate training, number of years in specialist endodontic practice, number of h per week treating patients, and the practice location.

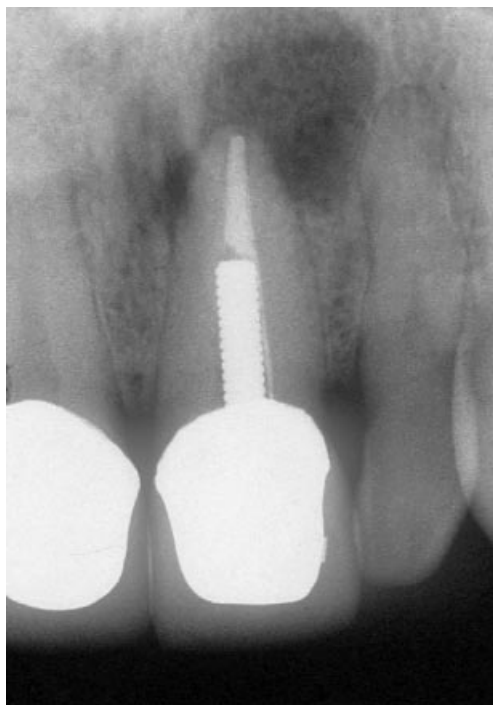
**2** An analysis of cases treated by the endodontists to determine the percentage of teeth that require root canal retreatment, the number of orthograde retreatment cases and the number of surgical cases treated each



**Figure 1** A cast post and core in a maxillary incisor tooth. Respondents were asked to indicate the instruments they would use to remove this post or any other treatment that they would recommend.

month. The attitudes toward the risk of root fracture during post removal were determined, as well as the treatment options considered for post removal and reasons for not removing a post. Each respondent was also asked to indicate whether they had ever fractured a root during post removal and to provide details of the case(s), if possible.

**3** Data were obtained about the post removal devices that were available in their practices and which ones they commonly used. Periapical radiographs of four clinical examples (Figs 1–4) were provided to determine the methods used to remove posts in the following specific situations: a maxillary anterior tooth with a cast post and core, a maxillary anterior tooth with a parallel-sided preformed post, a mandibular molar with a parallel serrated preformed post, and a maxillary anterior tooth with a fractured parallel-sided preformed post. The survey participants were advised to assume that root canal treatment was indicated because of the presence of symptoms and that there were no other complicating factors. They were asked to indicate their first and second choices for removing each post, and if post removal was not their preferred treatment, then they were asked to indicate what other treatment they would provide.



**Figure 2** A parallel preformed post in a maxillary incisor tooth. Respondents were asked to indicate the instruments they would use to remove this post or any other treatment that they would recommend.



**Figure 3** A parallel preformed post in a mandibular molar tooth. Respondents were asked to indicate the instruments they would use to remove this post or any other treatment that they would recommend.

#### Statistical analysis

Data from the returned surveys were entered into a database statistical software program (SPSS for Windows 6.1.31995, SPSS Inc, Chicago, IL, USA) for analysis.



**Figure 4** A fractured post in a maxillary incisor tooth root. Respondents were asked to indicate the instruments they would use to remove this post or any other treatment that they would recommend.

Chi-squared ( $\chi^2$ ) tests were conducted from contingency tables of different variables where the sample was large. When the sample was not large and the expected value was less than five, the Fisher's exact test was used. Statistical analysis was performed at the 95% level of confidence.

#### Results

There were 62 survey forms returned, which was a response rate of 84% of the ANZAE members. Retreatment of previously root-filled teeth constituted an average of 38% of all treatment performed by the respondents in their practices. The average number of root canal retreatments commenced each month was 27, with an average of three cases per month being treated surgically; the average number of posts removed each month was six. The majority of retreatment cases were treated by orthograde techniques and when a post was present in a tooth that required retreatment, 66% of respondents preferred to remove the posts, whilst 27% considered

removing the post or considered doing periapical surgery. Of the respondents who considered post removal and periapical surgery, 75% were concerned that post removal may cause the roots to fracture. However, of those that preferred to remove the post, only 46% were concerned about root fracture.

Forty-seven per cent of the respondents indicated that they would avoid removing posts in certain situations and the most common reason was the presence of a wide post and the concern that the root may fracture. Some other common situations were when:

- 1 The coronal restoration was deemed clinically satisfactory, particularly in situations where the cost to replace the coronal restoration was high;
- 2 Removal of the restoration would result in the tooth being unrestorable; and
- 3 The patient chose to have periapical surgery.

There was no statistically significant difference in the use of post removal devices amongst respondents who reported avoiding post removal in certain situations ( $\chi^2 = 0.81$ ,  $P = 0.37$ ).

#### Attitudes about root fracture

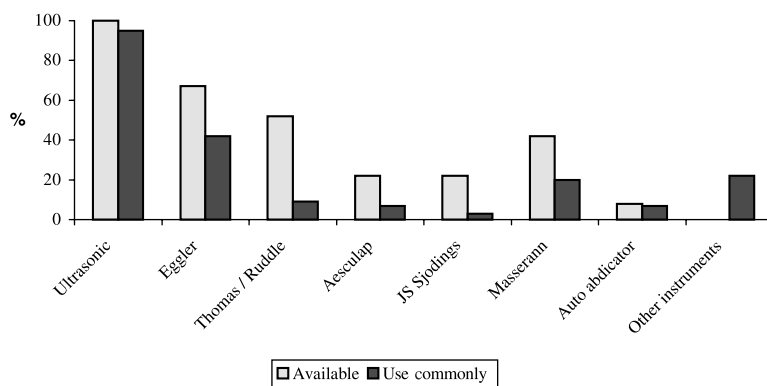
When considering possible complications of post removal, 55% of respondents were concerned about root fracture. The most common reason provided was previous experience of root fracture during post removal procedures and in several instances multiple reasons were given. Of the respondents concerned about root fracture, 61% had experienced the problem, 21% had read about it in journals, 18% were advised at dental school that it may occur, 18% were advised this at continuing education lectures, and 30% stated that this was a personal opinion. All respondents who avoided post removal in certain situations and were concerned about root fracture stated that they avoided removal of wide and long posts in thin roots. There was no association between the use of post removal devices and the respondents who were concerned about root fracture ( $\chi^2 = 0.26$ ,  $P = 0.61$ ).

Forty-five per cent of respondents reported that a root had fractured when removing a post in their clinical experience. Details of the circumstances of the root fracture were supplied by 21 of the 28 respondents who had fractured a root during post removal. The number of root fractures reported was extremely small when compared to the estimated total number of posts removed by endodontists, and represented less than 0.002% of the estimated number of posts removed by all respondents (that is, 40 fractures amongst an estimated 27 800 posts

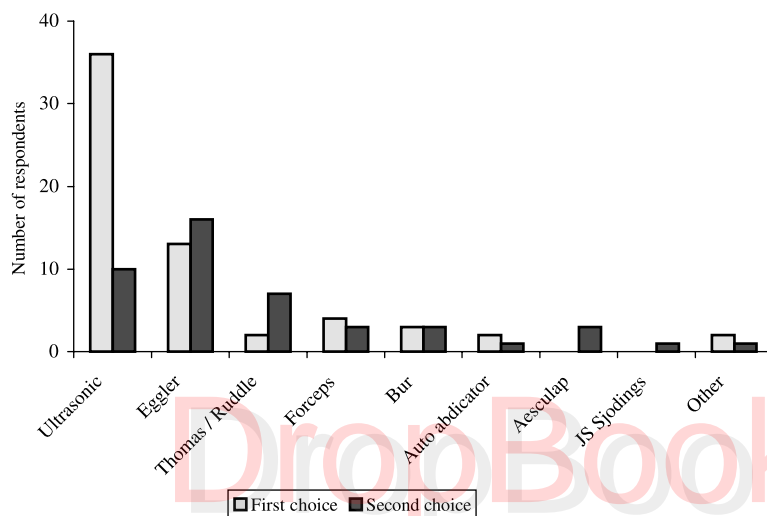
removed). Those respondents who commonly used a post removal device reported past experience of a root fracture more often than those who commonly used only ultrasonic vibration ( $\chi^2 = 4.13$ ,  $P = 0.04$ ). Of the respondents who reported root fractures when removing posts, most were aware of only one or two root fractures during their career. The most commonly reported factors associated with root fracture were a wide post, thin root structure and removing posts at an angle that was different to their path of insertion. There was no association between the use of post removal devices and root fracture, although five respondents reported root fractures whilst using the Auto Abdicator (Reicodent, Germany). This is a spring-loaded device that is designed to remove crowns rather than posts, although in some cases the posts are removed with the crowns. The most common fractures were small fractures of the coronal dentine but some were small slivers of root dentine, oblique fractures, or incomplete dentine cracks. Complete vertical root fractures were not commonly reported. Two respondents suspected that the root fracture might have been present prior to post removal in cases where fractures were subsequently confirmed. The amount of data provided about root fractures varied and it was not possible to perform meaningful statistical analysis of this data, although it was noted that the respondents who had experienced root fractures when removing posts were more likely to avoid removing posts in certain situations.

#### Instruments used for post removal

Respondents were asked to indicate the instruments they had available for post removal and those that they commonly used. The responses to these questions are summarized in Figure 5. Ultrasonic vibration was the most common method reported and it was available in 100% of surgeries and commonly used by 95% of the respondents. This was followed by the Egger post remover (available in 66% of surgeries and commonly used by 42% of respondents) and the use of the Egger device was related to the university where postgraduate endodontic training had been completed (Fisher's exact test  $P = 0.007$ ). There was no association between use of the Egger and concerns about root fracture ( $\chi^2 = 0.61$ ,  $P = 0.44$ ) or past experiences of root fracture when removing posts ( $\chi^2 = 1.87$ ,  $P = 0.17$ ). The Masserann kit was available in 43% of surgeries and was commonly used by 16% of the respondents. Use of the Masserann kit was not related to concerns about the risk of root fracture and past experiences with root fracture, although it was related to the university where postgraduate training was completed



**Figure 5** Instruments available and those commonly used by respondents for the removal of posts.

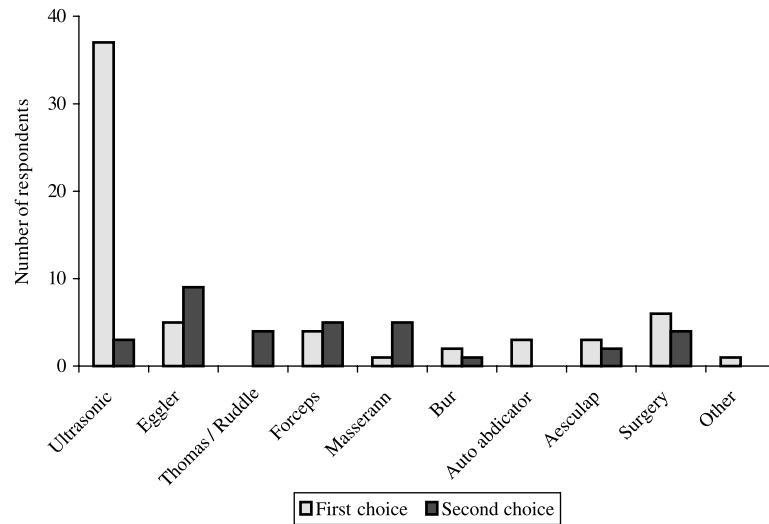


**Figure 6** The instruments that would be used by respondents to remove the cast post and core from the maxillary incisor tooth shown in Fig. 1.

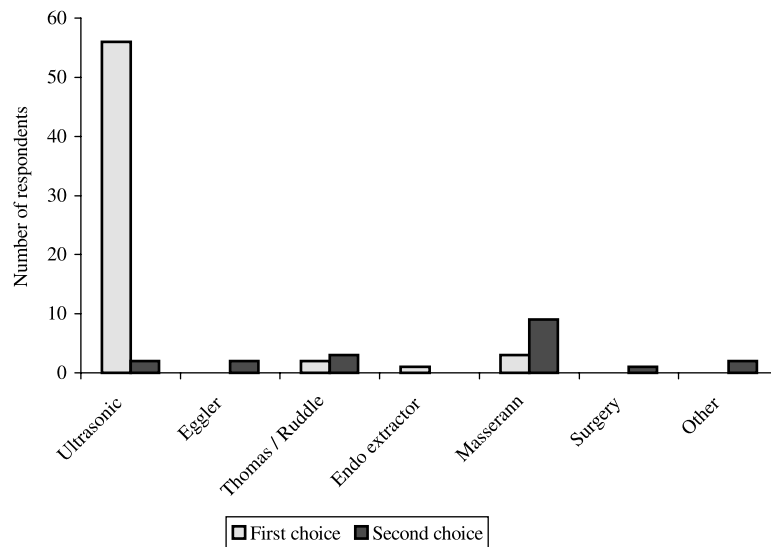
(Fisher's exact test  $P = 0.03$ ). The Gonon (Thomas) and Ruddle post removal systems have a similar method of action and were not commonly used by respondents, hence they were grouped together for the purposes of statistical analysis. These devices were available in 52% of surgeries, but they were commonly used by only 9% of respondents. Since the Gonon and Ruddle post removers were not often used, analysis of their use in relation to concerns about root fracture, the risk of root fracture and postgraduate training was not possible. Several respondents reported that they sometimes used more than one instrument in combination with another and the most common method used in conjunction with another device was ultrasonic vibration.

The graphs presented in Figures 6–9 indicate the primary instrument used to remove the posts in the specific examples shown in the radiographs supplied with the survey questionnaire (Figs 1–4). Ultrasonic vibration was the most common method used to remove the cast

post and core from a maxillary incisor tooth (Figs 1, 6). It was the first choice for 58% of respondents and it was used in conjunction with other instruments by 18%. The other instruments used included haemostats, forceps and burs. Ultrasonic vibration was the second choice for 16% of the respondents with their first choice being the use of a post removal device (the Eggler post remover, the Gonon post remover or the Auto Abdicator). Post removal devices were the first choice for 29% of respondents and the second choice for 45%. The Eggler post remover was the most common post remover used, being the first choice for 21% and second choice for 26% of the respondents. The Gonon (Thomas) and Ruddle post removers were the first choice of only 3% of respondents, although 11% indicated that one of these would be their second choice. Forceps and burs were used as the first choice by 5% and 3% of the respondents, respectively. Twenty-seven per cent of respondents did not indicate a second choice for removal of cast posts, but there was no



**Figure 7** The instruments that would be used by respondents to remove the parallel preformed post from the maxillary incisor tooth shown in Fig. 2.



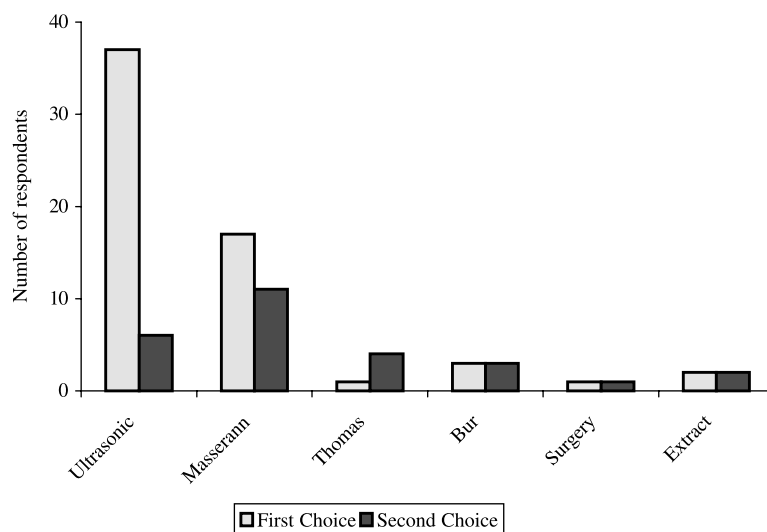
**Figure 8** The instruments that would be used by respondents to remove the parallel preformed post from the mandibular molar tooth shown in Fig. 3.

association between those who did not indicate a second choice and their 'first choice' instrument. In these cases, it could only be assumed that the respondents were very confident that their 'first choice' method would enable them to successfully remove the post.

Removal of a parallel-sided post in an anterior tooth (Fig. 2) with ultrasonic vibration was the first choice for 61% of the respondents (Fig. 7). Surgery was the first choice treatment for 10%, whilst post removal devices were the first choice for 21% and the second choice of 45% of respondents. The Egger post remover was used on its own or in conjunction with ultrasonic vibration as the first choice by only 8% of the respondents and as the second choice by 15%. The Gonon (Thomas) and Ruddle

post removers were not used by any respondents as the first choice to remove parallel preformed posts in anterior teeth and they were used by only 6% as the second choice. Forceps and burs were used in conjunction with ultrasonic vibration as the first choice by 7% and 3%, respectively, of the respondents. Only 50% indicated a second choice with the instruments used being evenly distributed.

In posterior teeth with a parallel, serrated preformed post (Fig. 3), the use of ultrasonic vibration was the first choice for 87% of respondents (Fig. 8). Only 29% indicated a second choice, with the Masserann kit being the most popular choice. Several respondents stated that the post would be removed by ultrasonics without the need for other devices.



**Figure 9** The instruments that would be used by respondents to remove the fractured post from the maxillary incisor tooth root shown in Fig. 4.

The removal of a fractured post from a maxillary anterior tooth (Fig. 4) would be performed with ultrasonic vibration alone by 54% of the respondents (Fig. 9), although several stated that this would be done with the aid of an operating microscope. The Masserann kit was the first choice of 27% of respondents and those who used a microscope did not tend to use the Masserann kit. Only 34% of respondents indicated a second choice, with half choosing to use the Masserann kit when ultrasonic vibration was not successful in removing the post.

## Discussion

The data presented in this survey indicated that post removal is preferred to periapical surgery by the majority of endodontists in Australia and New Zealand. The most common reason for avoiding post removal was the presence of a wide post with thin root structure as it was felt that removal of these posts might cause the root to fracture. This view was given more often by those respondents who had experienced a root fracture during post removal. Nearly half of the respondents reported fracturing a root during post removal, although the number of fractured roots represented less than 0.002% of the estimated total number of posts removed. Those respondents who commonly used post removers were more likely to have experienced a root fracture when removing posts. However, this needs to be considered in relation to the number of posts removed during their careers and the extremely low overall incidence of root fractures. It was not possible to determine from this survey whether any of the roots that fractured already had incomplete fractures

(or cracks) present prior to post removal. If an incomplete fracture or crack was present then it is very likely, if not a certainty, that it would propagate further during application of the post removal devices. Oblique fractures and fractures of small slivers of dentine were reported by some respondents. It is possible that these fractures, or their precursor cracks, may also have been already present in the tooth or, alternatively, they may have occurred due to the design and application of some of the post removal devices which place localized forces on the root face of the tooth.

Dentinal cracks were reported on the root face of some teeth in association with the use of ultrasonic vibration, although it is possible that these cracks were also present prior to post removal. During application of ultrasonic vibration to a post, the conductance of the vibratory forces along the post is proportional to the modulus of elasticity of the post, and materials with a higher modulus of elasticity will tend to conduct the ultrasonic vibration better. Altshul *et al.* (1997) compared the incidence of dentinal cracks in teeth after posts had been removed with either ultrasonic vibration or with the Gonon post remover and they reported a higher number of roots with intradentine cracks in the ultrasonic group even though vertical root fractures did not occur.

The use of the Auto Abdicator was associated with several root fractures in the current survey and this may be associated with the method of operation of this device, as well as application of the load at a different angle to the path of withdrawal of the post. The operation of this device is different to other post removal devices, because it provides a short and rapid load to the tooth. Clinically,

it is not usually possible to control the direction of application of this load to the post which may lead to root fracture. It is also worth noting that this device is designed to be used for removing crowns rather than posts, although often the post will dislodge with the crown. This will occur if the post and crown have been cast as a single entity rather than as two separate castings, or if the adhesion of the luting agent between the post and dentine is not as strong as the adhesion of the luting agent between the post/core and the crown. When assessing teeth clinically prior to removal of crowns and posts, it is not often possible to determine whether these situations exist and the type of luting agent used is not generally known.

Ultrasonic vibration was the most frequently used technique for the removal of all examples of posts in this survey – that is, for cast posts and cores, fractured posts in anterior teeth, and parallel-sided preformed posts in both anterior and posterior teeth. It was used more often to remove posts from posterior teeth and this is probably due to the limited access available for the application of post removal devices in these teeth. It is also a relatively efficient technique as shown by Buoncristiani *et al.* (1994), who compared the efficiency of ultrasonic and sonic vibration when removing parallel-sided posts. They reported that both the Enac (Osada Electric Company, Tokyo, Japan) and Cavi-Endo (Dentsply, York, PA, USA) ultrasonic devices were able to remove posts in less than 10 min, although Altshul *et al.* (1997) reported that the time taken was significantly less with the Gonon device ( $2.3 \pm 0.9$  min) than with ultrasonic vibration ( $7.7 \pm 4.9$  min). The relative ease of use of ultrasonics with parallel, preformed posts is probably related to the design of these posts, as it is unlikely that they will fit well in the coronal third of most root canals. This allows for easy breakdown of the cement in the coronal third and subsequent 'shifting' of the fulcrum point toward the apical end of the post. As the fulcrum point shifts apically, the ultrasonic vibrations start to move the post about this point and within the space created in the coronal third. This movement helps to break down the cement toward the apical end of the post in conjunction with the breakdown caused by the ultrasonic vibration itself – hence there are direct and indirect effects of ultrasonic vibration. Ultrasonic devices are also used by some clinicians to remove cement from around the post with a fine ultrasonic tip.

In the survey by Stamos & Gutmann (1993), post removal devices such as the Egger and Gonon (Thomas) post removers were the least commonly used devices because it was felt that they may cause root fracture, they

could not be used universally, or they did not work. In contrast, in the current survey there was no correlation between the use of these devices and concerns that post removal may cause roots to fracture. However, there was an association between the use and the type of post removal devices and the university where postgraduate training had been completed. The overall use of post removal devices was much greater in this survey than in the Stamos & Gutmann (1993) study, with the Egger being commonly used by 42% of the respondents. Although the Gonon (Thomas) and Ruddle post removers were available to over half of the respondents, only 9% actually used them. The greater popularity of the Egger device may be a result of it being considerably easier to use than the Gonon or Ruddle post removers, which require the use of trephine burs to reduce the post or core to the appropriate size followed by a mandrel that is attached to the post/core during its removal.

Several respondents used more than one instrument to remove posts. The most frequent combinations were the initial use of ultrasonic vibration in association with subsequent use of a post removal device, forceps or haemostats. The initial use of ultrasonic vibration on a post for 2 min has been shown to reduce the amount of force required to remove the post by 30% (Berbert *et al.* 1995) and the results of this study may have influenced some respondents to use ultrasonics in this manner prior to using other devices to remove posts.

## Conclusions

The general conclusions derived from this survey were:

- 1 When a post is present in a tooth requiring root canal retreatment, most endodontists surveyed preferred to remove the post rather than perform periapical surgery.
- 2 Endodontists were only concerned about root fracture in teeth with wide posts and thin root dentine.
- 3 Root fractures have rarely occurred during post removal, with a frequency of less than 0.002% of the estimated number of posts removed by the endodontists surveyed.
- 4 The most common method used to remove posts was ultrasonic vibration, whilst the Egger post remover was the most commonly used device, particularly for removing cast post and cores in anterior teeth.

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